# Certificate

I, ELIZABETH FLINT, residing at 2, CLEVELAND PLACE, EXMOUTH, DEVON, ENGLAND EX8 1BL

**hereby declare**

that I am familiar with the German and English languages and I am a professional translator.

That I have prepared a translation of Application PCT/EP2005/001108, filed February 04, 2005 and entitled „Gassack zum Einbau in ein Kraftfahrzeug" (Air bag for mounting in a motor vehicle), said translation thereof being attached thereto and made part of this declaration.

To the best of my knowledge and belief, the above-mentioned translation is accurate and fairly reflects the contents and meaning of the original document.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Executed on 5.01.2006 (5. January 2006)

Elizabeth Flint
(Name of Translator)

# Airbag for installation in a motor vehicle

## Description

### Technical background of the invention

The invention relates to an airbag for installation in a motor vehicle according to the introductory section of Claim 1.

Traditional airbags are provided with one or several outflow openings and are filled by means of a gas generator unit with a specified performance profile. Because of the geometry of the airbag, the performance profile of the gas generator unit and the cross-section of the outflow opening or the outflow openings, a certain internal pressure of the airbag, and therefore its hardness, results when it is in inflated state.

Ideally, the hardness of an airbag, in particular the hardness of an airbag used in a side airbag system, should be adapted to the body weight of the vehicle occupants. A relatively light occupant requires an airbag with less hardness, in other words with lower internal pressure, in order that the force exerted on the airbag when the relevant part of the body – for example the thorax – strikes it is as low as possible. Heavier vehicle occupants, on the other hand, require an airbag with greater internal pressure, as otherwise the overall retaining pressure for the occupant can be too low and there is a risk that the occupant may strike through to internal structure of the vehicle despite the presence of the airbag.

It is generally not possible to design each airbag in a vehicle to accord with the requirements of the specific occupants to be protected, as a vehicle is generally used by several people. It would therefore be desirable to have available an airbag which "recognises" if it has to protect a light or a heavy

occupant and which is in a position to provide different hardnesses as required.

State of the Art

A problem which is similar to the one described above is also present in the case of so-called "out of position accidents". Airbags are generally designed in such a way that they protect vehicle occupants who are in a "normal" seating position. If the occupant is in an atypical seating position, it may happen that he or she finds himself in the direction of expansion of the airbag, which means that the occupant can be injured if the airbag expands in an explosive manner. In order to reduce the seriousness of this problem, DE 100 18 170 A1 proposes an airbag which "recognises" if the occupant is positioned in the direction of expansion of the airbag, and, if this is the case, which limits the unfolding impulse. For example, the following embodiments are suggested in this connection:

In a first embodiment, the airbag exhibits two chambers, which are connected with each other by a type of valve. This valve arrangement is designed and implemented in such a way that the valve remains closed if the airbag strikes an obstacle during its expansion. In this case, only one chamber of the airbag is filled, so that the direction of expansion is shortened.

In another embodiment, the outer cover of the airbag exhibits a valve which is only closed if the airbag does not meet an obstacle. If the airbag does meet an obstacle, the opening remains open, which means that the expansion and the pressure in the airbag remain low.

The special forms of an airbag proposed in DE 100 18 170 A1 serve to limit the expansion of the airbag in the presence of an obstacle. The type of obstacle, and for example whether the vehicle occupant is large and heavy or

small and light, does not play a role here. This is also not necessary in order to solve the task set in this instance.

Starting from this state of the art, the task of the invention is to create an airbag which provides different hardnesses depending on certain physical characteristics of the vehicle occupants.

Object of the invention

This task is solved by an airbag with the characteristics of Claim 1.

The physical size of the vehicle occupant was selected as a criterion for the different inflation states of the airbag, as this is generally closely related to the weight of the occupant and can be "recognised" by the airbag without external aids.

The airbag exhibits at least one main chamber and at least one auxiliary chamber, whereby these chambers are connected with each other by means of a connecting opening. An outflow opening through which the gas exits is now arranged in or on the auxiliary chamber. A closing element is allocated to the outflow opening which blocks the gas path to the outflow opening wholly or in part when the auxiliary chamber meets an obstacle when the airbag is expanded or during expansion of the airbag.

Such an airbag can now be dimensioned and arranged in such a way that the main chamber forms a thorax chamber and in the case of a large occupant lies at the height of this occupant, but in the case of a small occupant is located above the shoulders of the occupant. If a large occupant now meets such an airbag, the outflow opening is blocked, which means that the pressure in the main chamber is increased accordingly. In the case of a small occupant, however, the outflow opening remains linked to the main chamber,

so that gas can flow out of the main chamber, which leads to the desired reduction in pressure in the main chamber and therefore to a softer airbag.

In a preferred embodiment, the auxiliary chamber exhibits an inner and an outer chamber. Within this arrangement, the outer chamber is connected with the main chamber and the auxiliary chamber exhibits a valve opening by means of which the outer chamber is connected with the outflow opening which is situated on the inner chamber. If the auxiliary chamber meets an obstacle, a part of the fabric layer of the outer chamber is pressed onto the valve opening, and the gas path between the main chamber and the outflow opening is interrupted.

Further preferred embodiments result from the further subclaims as well as from the example embodiment described in more detail with reference to the drawings. The drawings are as follows:

Short description of the drawings

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| Figure 1 | A perspective view of an airbag according to the invention, |
| Figure 2 | A section through Figure 1 along Plane A, |
| Figure 3 | Detail D from Figure 2, |
| Figures 4-7 | The mode of functioning of the airbag according to the invention, |
| Figure 8 | A second embodiment of an airbag according to the invention in a side view, |
| Figure 9 | A section along plane B-B from Figure 8, |
| Figure 10 | A fabric section for the two outer fabric layers of an airbag according to a third embodiment, |
| Figure 11 | The fabric section for the two inner fabric layers of the third embodiment and |
| Figure 12 | A section through the airbag of the third embodiment in a section view corresponding to Figure 9. |

Description of preferred embodiments

First embodiment

The structure of the airbag according to a first embodiment which here is in the form of a side airbag is now described with reference to Figures 1 to 3. The airbag exhibits three chambers, namely the main chamber 10 designed in the form of a thorax chamber, the pelvic chamber 20 and the auxiliary chamber 30. The main chamber 10 and pelvic chamber 20 serve to retain vehicle occupants, while auxiliary chamber 30 primarily serves pressure regulation of main chamber 10.

As can best be seen from Figures 2 and 3, auxiliary chamber 30 is sewn onto main chamber 10 by means of seam areas 42. Furthermore, main chamber 10 and auxiliary chamber 30 are connected with each other by means of a connecting opening 14, so that exchange of gas can take place between main chamber 10 and auxiliary chamber 30.

Auxiliary chamber 30 is again itself formed in two pieces, of an inner chamber 32 with an inner fabric layer 32a and an outer chamber 36 with an outer fabric layer 36a. The aforementioned connecting opening 14 is a common opening of fabric layer 10a of the main chamber and the outer fabric layer 36a.

The inner chamber 32 and the outer chamber 36 are each basically tubular in form as can best be seen in Figure 1. In this, the outer fabric layer 36a is shown broken open in a certain area, so that the area of inner chamber 32 is recognisable. Inner chamber 32 and outer chamber 36 exhibit a common front side 40 in which outflow opening 35 is located, which connects the interior of inner chamber 32 with the environment outside the airbag.

Valve opening 34 is located in inner fabric layer 32a, which connects inner chamber 32 with outer chamber 36 (see Figures 1 to 3). If the airbag can expand unhindered (this corresponds to the situation shown in Figures 1 to 3), the main chamber is connected with the environment, i.e. gas can flow out of the main chamber into the environment. In this situation, the gas path is as follows: the gas first flows from main chamber 10 through connecting opening 14 into outer chamber 36, from there through valve opening 34 into inner chamber 32 and from there through outflow opening 35 to the outside. Depending on the performance of the gas generator (not shown) and the selected geometry, a certain internal pressure is by these means created in main chamber 10.

Valve opening 34 and connecting opening 14 can be in the form of holes in the respective fabric layers or as gas-permeable fabric areas.

If a part of outer fabric layer 36a is now pressed against valve opening 34, this latter is completely or partly closed and the flow of gas from main chamber 10 to the outside is throttled or completely stemmed, so that with a given gas generator performance a higher internal pressure is created in main chamber 10. Therefore a section of outer fabric layer 36a serves in this embodiment as a closing element, which blocks or throttles the gas flow.

The mode of functioning of an airbag according to the invention which is installed in a motor vehicle will now be described in relation to Figures 4 to 7, whereby the inner side of the vehicle is designated with reference letter F.

Figure 4 shows the airbag which is inflating next to a large vehicle occupant G during a side-on collision. If a relative movement now occurs between the large occupant G and the airbag, the shoulder area of the large occupant G comes into contact with auxiliary chamber 30, whereby the outer fabric layer 36a, as shown above, covers valve opening 34, which causes the gas flow from main chamber 10 to be stemmed (see Figure 5). This leads to a large

internal pressure and therefore to a greater hardness of the main chamber, which is sufficient to capture the large and generally also heavy occupant G.

Figures 6 and 7 show the situation if a small occupant K is present. Here too, in the case of a side-on collision a relative movement occurs between the small occupant K and the airbag, but the shoulder area is located under auxiliary chamber 30, so that the outer fabric layer 36a is not pressed against valve opening 34. This leads to the gas path from main chamber 10 to outflow opening 35 remaining free, whereby the desired lower pressure occurs in main chamber 10.

Second embodiment

Figure 8 shows a second embodiment in a side view. This embodiment exhibits a main chamber 10 and an auxiliary chamber 30, but no pelvic chamber 20; such a chamber can, however, also naturally be present in an airbag which is implemented in this way. Main chamber 10 and auxiliary chamber 30 are formed by both outer fabric layers 51,52 being sewn together in sections in the transitional area between main chamber 10 and auxiliary chamber 30 in connecting area 57 (see also Figure 9). This means that two connecting openings 14 are formed, which are located on the left and right of connecting area 57 respectively.

The outflow opening 35 which is located in the first outer fabric layer 51 is covered by a covering fabric 64 whose first and second sides 64a,64b are not sewn together with the first outer fabric layer 51, so that here gas coming from outflow opening 35 can enter the interior of the vehicle. If auxiliary chamber 30 is pressed onto the inner structure of the motor vehicle, for example by the shoulder of the occupant, outflow opening 35 is closed by covering fabric 64 lying on the inner structure and the gas stream is stopped. The covering fabric therefore forms the closing element. The basic functional principle is therefore identical with that of the first embodiment.

Third embodiment

Figures 10 to 12 show a variant of the embodiment just described. The difference is here that two auxiliary chambers 30a,30b are present. Because of the special arrangement of these two auxiliary chambers 30a,30b (see Figure 12) a good outflow behaviour can be achieved in a simple way on the one hand and if necessary good closing behaviour of the outflow openings is also implemented. The cover of the airbag is manufactured of only two fabric sections.

Figure 10 shows a first fabric section 54, from which the first outer fabric layer 51 and the second outer fabric layer 52 are created. Within this, main chamber 10 is created beneath broken line L, while auxiliary chambers 30a, 30b are created above broken line L. As also in the variant just described, a connecting area 57 is provided. Furthermore, gas generator opening 59 is provided in the first fabric section 54 in the transitional area between first outer fabric layer 51 and second outer fabric layer 52.

Figure 11 shows the second fabric section 50, from which the first inner fabric layer 55 and the second inner fabric layer 56 are formed. Furthermore, the outer capture tape 60 is located on the second fabric section 50. The two outflow openings 35 are located in second fabric section 50 as well as four inner capture tapes 58, which are connected with the first outer fabric layer 51 or the second outer fabric layer 52 during the manufacturing process.

The two fabric sections 50, 54 are sewn together as described in the following text. Second fabric section 50 is folded over along mid line M and then the first inner fabric layer 55 is sewn together with the first outer fabric layer 51 along the first seam 53a and the second inner fabric layer 56 is sewn together with the second outer fabric layer 52 along the second seam 53b. Furthermore, the inner capture tapes 58 which are already joined with the sec-

ond fabric section 50 are sewn together with the respective opposite areas of the outer fabric layers 51,52. Finally, all four fabric layers are joined together in connecting area 57 by means of sewing. As a last step, the top edges of auxiliary chambers 30a,30b are joined together by means of outer capture tape 60. This results in the configuration shown in Figure 12, which is a section according to representation of Figure 9 and which shows the situation when the airbag is fully expanded:

All four fabric layers are sewn together in connecting area 57. Below this connecting area 57 is main chamber 10, above connecting area 57 are the two auxiliary chambers 30a,30b. The thickness of the two auxiliary chambers is limited by two capture tapes 58 respectively. The gas flow from the main chamber into the auxiliary chambers occurs to the left and right of connecting area 57 (this cannot be seen from the representation in Figure 12). The two auxiliary chambers 30a,30b are connected with each other at their upper ends by means of outer capture tape 60, so that an intermediate area 62 which is basically open to the top and side is created between the two auxiliary chambers 30a,30b. The two outflow openings 35 end in this intermediate area 62, so that direct flow onto the vehicle occupant or the side structure of the vehicle are avoided. Outflow openings 35 are closed if the two auxiliary chambers 30a,30b are pressed onto one another by an external obstacle, for example the shoulder of the occupant. This means that the one auxiliary chamber forms the closing element of the other auxiliary chamber.

List of reference numbers

| | |
|---|---|
| 10 | main chamber |
| 10a | fabric layer of main chamber |
| 14 | connecting opening |
| 20 | pelvic chamber |
| 30 | auxiliary chamber |
| 32 | inner chamber |
| 32a | inner fabric layer |
| 34 | valve opening |
| 35 | outflow opening |
| 36 | outer chamber |
| 36a | outer fabric layer |
| 40 | front side |
| 42 | seam area |
| 50 | second fabric section |
| 51 | first (outer) fabric layer |
| 52 | second (outer) fabric layer |
| 53a | first seam |
| 53b | second seam |
| 54 | first fabric section |
| 55 | first inner fabric layer |
| 56 | second inner fabric layer |
| 57 | connecting area |
| 58 | inner capture tape |
| 59 | gas generator opening |
| 60 | outer capture tape |
| 62 | intermediate area |
| 64 | covering fabric |
| 64a | first side |
| 64b | second side |
| G | large vehicle occupant |

| | |
|---|---|
| K | small vehicle occupant |
| F | inner side of vehicle |